



City of Hampton
Illicit Discharge Detection and Elimination
Procedures Manual



FY18

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Introduction

This document is intended to serve as an illicit discharge detection and elimination (IDDE) guidance manual for the City of Hampton. An illicit discharge is “Any discharge to a municipal separate storm sewer system that is not composed entirely of storm water, except discharges pursuant to a National Pollutant Discharge Elimination System (NPDES) permit and discharges resulting from fire-fighting activities.”

Regulations and Requirements

Established in 1972 and amended in 1977 and 1987, the Clean Water Act (CWA) is the primary federal law governing water pollution. The Act requires states to set clean water standards to protect uses such as swimming, fishing, and drinking, and for the regulation of pollution discharges. The CWA initially focused on addressing water quality issues caused by point sources of pollution (e.g., wastewater treatment plants and industrial Discharges) by making it unlawful to discharge any pollutant into navigable waters, unless a permit was obtained under CWA’s provisions. These permits, known as National Pollutant Discharge Elimination System (NPDES) permits, prevent the degradation of water quality by limiting pollution discharges to what can be safely assimilated by the environment. In 1987, the CWA was expanded to include non-point sources of urban pollution by requiring municipalities with separate storm sewer systems (referred to as “MS4s”) to be permitted. Phase I of these permits, issued in 1990, requires medium and large cities or certain counties with populations of 100,000 or more to obtain NPDES permit coverage for their stormwater discharges. Phase II, issued in 1999, requires regulated small MS4s in urbanized areas, as well as small MS4s outside the urbanized areas that are designated by the permitting authority, to obtain NPDES permit coverage for their stormwater discharges. Generally, Phase I MS4s are covered by individual permits and Phase II MS4s are covered by a general permit. Each regulated MS4 is required to develop and implement a stormwater management program to reduce the contamination of stormwater runoff and prohibit illicit discharges.

What is required?

Recognizing the adverse effects illicit discharges can have on receiving waters, the Phase I Final Rule requires an operator of a regulated large MS4 to develop, implement and enforce an illicit discharge detection and elimination (IDDE) program, which is one of six minimum measures required under the Phase I stormwater program. The IDDE program must include the following:

- A storm sewer system map, showing the location of all outfalls and the names and location of all waters of the United States that receive discharges from those outfalls;
- Through an ordinance, or other regulatory mechanism, a prohibition (to the extent allowable under State, Tribal, or local law) on illicit discharges into the MS4, and appropriate enforcement procedures and actions; Stormwater Code 33.2-27 (Appendix A)
- A plan to detect and address illicit discharges, including illegal dumping, into the MS4;
- The education of public employees, businesses, and the general public about the hazards associated with illegal discharges and improper disposal of waste; and
- The determination of appropriate best management practices (BMPs) and measurable goals for this minimum control measure.

This document provides guidance on procedures utilized for detecting and tracking illicit discharges through:

- community reporting
- desktop assessment of illicit discharge potential
- field screening of outfalls to detect illicit discharges
- drainage area investigations to locate and remove the source of the discharge

Illicit Discharge Assessment Techniques

The City of Hampton monitors for illicit discharges using multiple methods. The primary method of finding an illicit discharge is through the 311 call center. Citizens can report any possible illicit discharge request and the Environmental Services division will investigate the claim ASAP, typically within 24 business hours. Each notification begins with a desktop assessment for an illicit discharge potential, investigating area for industrial permitted sites and field screening of the stormwater outfalls. These techniques combined give the City of Hampton the greatest chance to eliminate illicit discharges from entering the stormwater system, and inevitably Hampton's waters and the Chesapeake Bay. Below is a brief description of each technique:

A. 311 Call Center

The City of Hampton's 311 Call Center can be reached by dialing 311 on any landline phone in Hampton, or by dialing 757-727-8311. Potential illicit discharge complaints will be forwarded to Environmental Services within the Stormwater Division of the Public Works Department. Environmental Services holds a self-imposed 24 business hour response time for all investigations. Emergency situations are forwarded to the Fire Department.

B. Desktop Assessment

A desktop assessment of illicit discharge potential uses mapping and other available data to determine the potential severity of illicit discharges within the City of Hampton. Areas such as permitted and non-permitted industrial or commercial businesses, public and private car wash companies, auto-repair companies, and current construction projects all carry higher risk associated with illicit discharges. Use of aerial photography, GIS mapping of stormwater and wastewater utility lines, historical call center tracking, and other electronic data assist Environmental Services in focusing in on high-priority outfalls to screen for illicit discharges. This assessment may also provide assistance with narrowing down outfalls outside of residential areas that have the best chance to catch potential discharges from a large area.

C. Field Screening of Outfalls

Rapid field screening of stormwater outfalls in priority areas is conducted during dry weather to identify potential transient illicit discharges (i.e., temporary flowing outfalls) and is followed by indicator monitoring to characterize flow types to aid in finding sources. Dry weather has to be present ($< .1''$ in 48 hour period) to test unless it is obvious discharge or dumping into the stormwater system. The City of Hampton is required to screen a minimum of 60 outfalls every fiscal year. While industrial and commercial areas are considered high priority, residential areas are also screened for potential dumping of oils, cooking grease, and other illegal discharges to the stormwater system.

D. Non-Routine Inspections

Outside of Environmental Services, the Stormwater Division is trained annually to identify potential discharges into the stormwater system and report it to their manager. These sections deal with construction, maintenance, and mapping. This process allows a vast majority of the system to be inspected throughout the year. If an employee witnesses an illicit discharge occurring, he/she will contact their manager immediately, take notes, pictures, and document any other pertinent information they deem necessary.

Dry Weather Screening Procedures

Preparation for Daily Screening Activities

Before Dry Weather Sampling can start, there are a few activities that must be done before a field crew collects a sample. Listed are the steps taken in preparation of sampling.

- A. Checking Weather Conditions – In order to collect samples, dry weather conditions must exist. The field supervisor will check at least two weather monitoring stations and fill out the weather conditions log (Appendix B). Use the following to determine if dry weather conditions exist:
 1. If rainfall was less than ($<$) 0.1 inches for the previous 48 hours, dry weather conditions exist, and sampling may proceed.
 2. If rainfall was more than ($>$) 0.1 inches for the previous 48 hours, but less than ($<$) 1 inch for a 24 hour period, a rainfall event has taken place and 48 hours must elapse prior to continuance of sampling.
 3. If rainfall was more than ($>$) 1 inch for a 24 hour period, a storm event has taken place and 72 hours must elapse prior to continuance of sampling.
 4. If there has been snowfall with no accumulation within a 24 hour period, a snow event has taken place and 72 hours must elapse prior to continuance of sampling.
 5. If there has been snowfall with accumulation, a snow storm event has taken place and 72 hours must elapse from a period of time allowing all snowmelt to occur.
- B. pH and Temperature Meter Calibration – If dry weather conditions exist, the next step before field collection is to calibrate the pH and temperature meter. The field supervisor or designated team member must calibrate the meter according to the instructions in the kit, and fill out the appropriate portion of the weather conditions log.
- C. Sampling Locations – After the weather conditions log is completed and the pH and temperature meter is calibrated, a list of potential sites is given to the team to evaluate before going into the field. Locations are based on potential discharges from commercial, industrial, or residential locations. Other locations that are sampled may include industrial sites with separate VPDES permits, active construction sites with SWPPP's, as well as any 311 requests that have been forwarded to the Environmental Services office.

- D. Equipment Checklist – The final step before you leave for the sampling sites is to ensure all equipment is cleaned and packed for the field. Other than the Illicit Discharge Field Sheet (Appendix C), utilize the equipment checklist (Appendix D) to ensure all equipment needed is available. The IDDE utility belt holds your refractometer, pH and temperature meter, a GPS tracker, measuring tape, sampling pole, two collection jars and de-ionized water. The photometer carrying case allows transport for the photometer and all accompanying testing equipment. A transparent plastic shatter proof case will allow for transport of testing materials, kimwipes, chemical waste bin, a box of gloves, and safety glasses. Additionally, make sure that you have an appropriate safety vest. For possible illicit discharge sites on or around construction, you may be required to wear a hard hat as well.
- E. Vehicle Safety Check – After all equipment is cleaned, calibrated and ready for field sampling, make sure to do a complete safety inspection on the truck that you are utilizing for the day. The “Vehicle Safety Log” should be filled out before leaving the Public Works Yard.

Screening Methods and Procedures

This section will explain methods and procedures when arriving at a potential illicit discharge site.

- A. Parking and Notifying Oncoming Traffic – When arriving at a possible illicit discharge site, make sure that an appropriate parking area is available that is conducive for onsite testing, as the Photometer 9500 is designed to be utilized in the field for quick results. The tailgate is an approved site that can be utilized to test for discharges. Parking off the street is preferred if there is a public area to do so, as to reduce any risk of a traffic accident. If off street parking is not available, find an appropriate spot on the side of a non-primary road to park, notifying traffic with your emergency flashers. Do **NOT** park on the side of a busy street and test with your back against traffic.
- B. Safety Equipment – Before exiting the vehicle, make sure that you have on all safety equipment needed at the discharge site. This includes, but is not limited to, safety vest, hard hat, safety goggles, rubber gloves and steel toe boots. Due to some locations of potential illicit discharge sites, employees may want to wear insect repellent to eliminate threats of tick and mosquito-borne diseases. Be aware of snakes and other animals that may use outfalls and ditch banks as harborage.
- C. Equipment Needed at Discharge Point – Not all equipment is needed at the point of discharge, so make sure you only carry the equipment that is needed at the specific site. Everything in the utility belt is necessary, your Illicit Discharge Field Sheet, sample pole and camera are all items that are needed onsite.

- D. Site Check – When approaching a possible illicit discharge testing site, be conscious of your surroundings, smells, hazards, or other items that may cause injury. Once you are at the site, you are ready to collect data and complete the Illicit Discharge Field Sheet. Location, date, time, and inspection team are all essential information that can be completed prior to leaving the vehicle.

Once at the site, complete the worksheet and note any details that could later be used. Smells, amount and density of vegetation, any biological features, and presence of trash are all important when completing the paperwork. If there are multiple outlets or potential sources of discharge at the location you are at, make sure to check each one for flow. While you may be at the location for one outlet, you may find a small pipe leading into the same ditch further down the bank. Complete the worksheet for the pipe location you were given, and another for the pipe that may have the potential discharge. Whether flow was observed or not, the Illicit Discharge Field Sheet must be completed. All sites discharging must be tested with the refractometer to determine if the site has tidal effects.

- E. Collection of Sample – If flow is observed at the discharge site, a sample needs to be taken for testing. Sites can vary greatly depending on the location, so sampling methods are sometimes site specific. There are, however, certain general methods that need to be observed across all collections.

Collection of Samples using the Extendable Sampling Rod – If a location is not within reach of the collector, a sampling rod must be utilized. A separate collection jar is attached to the end of the rod and dipped into the site at an angle with the opening of the collection jar against flow. The sampling jar is rinsed with the discharge and then the sample collected again before bringing the sample up to the collector. The glass sampling jar is then filled, and the rest of the sample is emptied. Note color, clarity, odor, and floatables at this time and complete the appropriate section of the worksheet. If the sampling rod and collection jar is used, the collection jar must be rinsed with de-ionized water upon returning to the truck to reduce the possibility of cross contamination.

Collection of Samples directly from the site – If a sample can be safely collected without using the extendable sampling rod; the inspector can acquire the sample by hand. Ensure that both safety goggles and rubber gloves are worn during the sampling procedure. Thoroughly survey the site to ensure there is no slip or fall hazards around the site. Protocol dictates that when sampling with the extendable rod, every sampling jar must be rinsed with the potential illicit discharge flow. Dip the glass sampling jar into the discharge with the mouth of the sampling jar against the flow. Note color, clarity, odor, and floatables at this time on the appropriate section of the worksheet.

- F. Field Testing – If there is sufficient time and a safe space for testing in the field, it is recommended to do so. Make sure there are no traffic hazards before utilizing the tailgate of the vehicle. Gather all testing equipment, testing supplies, chemical waste bin and deionized water from the truck and place them in the rear of the vehicle. Each test has specific instructions, directing how each sample is prepped before placing the reagent mix into the photometer. All personnel must receive specific training through the Environmental Services Biologist and be comfortable with performing the tests before utilizing the equipment. See Appendix F for Photometer Instructions.

** Note - To reduce test time, protocol indicates initiating the tests that require longer stand times (10 minutes +) and then move onto the tests that can be checked immediately.

- G. Laboratory Testing – If there is no appropriate testing site out in the field, or if there are time constraints, inclement weather approaching, or anything that prevents you from testing after the collection of the sample, laboratory testing can be done. When transporting a sample to the laboratory, place in a cool shaded area of the truck, do not put the sample in direct sunlight or leave the sample in a heated truck for any length of time if possible. When arriving at the Environmental Services office, place the sample in the refrigerator located in the lab and notify the field supervisor or Environmental Services manager. If a sample is collected and returned to the Environmental Services office, be sure to label the sample and leave the Illicit Discharge Field Sheet in the lab.

Testing Instructions

The City of Hampton's Environmental Services Division is responsible for all IDDE Testing. This includes testing for E. coli and Fecal Coliform bacteria, Dissolved Oxygen, Detergents, as well as Ammonia, Bromine, Chlorine, Copper, Phenols and Phosphates. This last group of testing utilizes the Photometer 9500 Field Screening Kit. Instructions on all of the testing procedures are as follows:

A. Photometer 9500

The Photometer 9500 is field testing kit designed to streamline on-site and laboratory testing to increase safety and productivity. Current parameters the City of Hampton may test include Ammonia, Chlorine, Copper, Nitrates, pH, Phenols and Phosphates. Each test has individual packages with specific instructions, and should be followed without deviation.

Instructions Prior to Testing

Before testing begins, insure all equipment is clean and functional. Glass sampling jars and testing vials must be washed prior to leaving the office. Washing is conducted using de-ionized water and the appropriate cleaning agent found in the Environmental Services laboratory. The photometer kit should contain the Photometer 9500, testing vials and caps, safety glasses, spare testing sticks, and light cap for the photometer.

Testing Instructions

After a sample is collected, set your testing material out so that there is ample room to work. Personal protective equipment must be worn while testing is conducted by all personnel in the immediate area. There are six tests performed with the photometer 9500, each with individual instructions that are kept with the individual tests. A copy of each test and instructions are found in Appendix F. All chemical waste is disposed correctly and according to SDS requirements.

**** Note –** To reduce test time, protocol indicates initiating the tests that require longer stand times (10 minutes +) and then move onto the tests that can be checked immediately.

Record Keeping

While test results will be noted on the Illicit Discharge Form with the site information, the photometer 9500 is capable of transferring results electronically to your PC. FY17 will be the first year that this strategy will be put in place as a secondary electronic record. Results will be kept on a city network.

B. Coliscan MF

Environmental Services is capable of testing for E. coli and fecal coliform bacteria in case of a wastewater leak or other negative environmental impact. Step by step instructions for the coliform testing can be found in the test box, as well as in Appendix G. These instructions are very important to read or have nearby every time the test is being performed. Bottles of the solution required to perform the tests must be kept in a freezer, and thawed prior to testing. After preparation and setup have been completed, specimens must be kept in a warm to hot area (not in direct sunlight or over a direct heating source) or in an incubator for 24-48 hours for incubation time. Once the specimens have begun to incubate, another 24 hours is needed for complete growth to take place. Only once the incubation period is complete, can a count of the colonies be conducted. All terminated testing samples are sealed in a plastic bag and disposed at the Steam Plant for incineration.

QA/QC Procedures

The quality assurance/ quality control procedures are listed below.

If testing results in any values that are cause for concern, a retest of that constituent will be conducted immediately. If the second test shows substantially different results, a third test will be done. All results will be recorded.

A sample is required for laboratory verification and if the second test verifies the first test, or, if the third test still indicates values identified as cause for concern. Collect a sample in the specially marked containers, place the container on ice, and call HRSD's Technical Services Division (Danny Barker 460-4247 or Jamie Heisig-Mitchell 460-4258) for further direction. These samples must be transported to the District Lab before the end of the work day (3:30 pm) so that analysis can be conducted on the sample within the prescribed holding time for the intended parameters.

At least 10 percent of sample collected by each crew will be split and one part will be analyzed in the field and the other will be sent to the lab for analysis. Included in this 10% calculation is verification for causes of concern. The Chain of Custody Record for the laboratory samples can be found in Appendix H. The samples for the laboratory must be kept in a cooler on ice.

The field supervisor will check the field logs each day to ensure this documentation is completed daily and that resampling and duplicate analysis is occurring as required.

Follow up and Tracking Procedures

All outfalls with a confirmed discharge will require testing and a drainage area investigation. If a sample comes back above threshold levels, a follow up is required, and if found positive for any quantities tested, tracking procedures will be followed.

- A. Follow up Procedures - If the outfall is determined to have a potential illicit discharge based on physical indicators, but samples do not exceed established water quality thresholds, the outfall will be revisited two additional times during the permit cycle to determine if an intermittent discharge may be present. It is recommended that one re-visit will occur on a different day of the week, other than the original visit day of the week, and at a different time of day.
- B. Tracking Procedures - If the outfall is determined to have a confirmed illicit discharge based on exceeded threshold levels or physical indicators, a drainage area investigation will be immediately performed. Tracking an illicit discharge should be performed by a minimum of two employees, and may consist of the Environmental Services Manager, Stormwater Operations Manager or Stormwater Engineer. Prior to the site visit a map should be obtained of the surrounding stormwater drainage area to ensure proper tracking. To track, follow the stormwater infrastructure from the outfall upstream, closely inspecting at each access point, until you reach either the source of the discharge or a split in the infrastructure. If split, continue inspection of each branch until source is located. For multiple outlets, the stormwater map should show direction of flow, however; visible evidence takes precedence.

If it is unclear which direction the flow is coming from, both paths should be inspected. If you're tracking leads to private property in which entrance cannot be obtained, refer to the stormwater GIS map to see if any other stormwater structures that are past the point of private property may be connected and inspect those for flow. If no flow is present prior to the private property, an onsite investigation should occur. If the property is inaccessible, refer to the enforcement section.

Once the illicit discharge source is located, contact the property owner to stop further discharging ~~from happening should be made~~. If a discharge is presumed hazardous, contact the Fire Department HAZMAT Team immediately. Further actions will be discussed in the enforcement section. Upon locating, all chemical and hydrocarbon illicit discharge sources entering the MS4 system must be reported to the National Response Center and treated as a spill (1-800-424-8802).

The use of the Stormwater CCTV Truck may be utilized to assess subterranean infrastructure when necessary.

Enforcement

Once the source of an illicit discharge has been identified, steps must be taken to remedy or eliminate the discharge. Four questions should be answered for each illicit discharge to determine how to proceed; the answers will usually vary depending on the source of the discharge.

- Who is responsible?
- What methods will be used to repair?
- How long will the repair take?
- How will removal be confirmed?

Financial responsibility for source elimination and removal will typically fall on property owners and/or the MS4 operators. Methods for removing illicit discharges usually involve a combination of education and enforcement. The Hampton City Attorney's office can be contacted for direction insuring proper enforcement measures. The Stormwater Manager should use judgment in exercising the right mix of compliance assistance and enforcement. The authority and responsibility for correction and enforcement is clearly defined in the Hampton City Code, Section 33.2-27. An escalating enforcement approach is often warranted and is usually a reasonable process to follow. Voluntary compliance should be used for first-time, minor offenders. Often, property owners are not aware of a problem, and are willing to correct when educated. More serious violations or continued non-compliance will warrant a more aggressive, enforcement oriented approach. Please refer to the City of Hampton's MS4 Program Plan manual for any further questions.

Post-Removal Confirmation

After completing the removal of illicit discharges from an area, the area is re-inspected to verify corrections have been completed. Depending on the extent and timing of corrections, verification monitoring can be conducted at the initial junction manhole or outfall, or the closest downstream outfall to each correction. Verification is accomplished by using the same visual inspection and field monitoring as described in previous sections.

Illegal Dumping Investigations

Investigations for Illicit Discharge and Illegal Dumping not pertaining to the Dry Weather Screening section will be investigated on an as needed basis. A separate field sheet will be used, which can be found in Appendix I. This form has three sections; the first section applies to all investigations and has pertinent information to include date, location, inspectors, etc.; the second section is a smaller version of the dry weather screening information, and is only used when there is a sample collected. This section will be completed while in the field, and then a team will be dispatched to the location and will implement dry weather screening procedures. The third section on the field sheet will be completed for the following four sections which discuss illegal dumping situations.

Tire Collection

The City of Hampton currently offers to retrieve up to 5 tires a week, up to 10 tires a year for residents (not businesses or commercial customers) of Hampton who receive weekly trash pickup. More information can be found at the Solid Waste section of the city's website (<http://hampton.gov/index.aspx?nid=333>).

Environmental Services routinely inspects historic illegal tire dumping sites for recent infractions and works with Codes and Law Enforcement to reduce the number of illegal dumping sites.

Grass Clipping and Leaf Debris

The City of Hampton Solid Waste division currently offers pickup of leaf and yard debris when putting in a request through the 311 Call Center, or filling a form out on the website (<http://hampton.gov/index.aspx?nid=333>).

Environmental Services receives 311 tickets based on citizen complaints throughout the year for either grass clippings or leaf debris being placed in a stormwater conveyance system (curb and gutter, back ditch, etc.). Clearly defined in the **Hampton City Code 33.2-26 (d)**;

It shall be unlawful for any person to throw place, deposit, or cause to be thrown, placed or deposited, in any gutter, ditch, storm drain, or other drainage area in the city anything that impedes or interferes with free flow of stormwater therein.

Grass clippings and leaf litter should be kept in the yard, and/or bagged for pickup in accordance with rules found on the Solid Waste page. Contractors and residences found to be violating this article will be notified in person, and given a copy of the code to educate about the violation. Repeat offenders **will** be pursued with enforcement.

Oil Spills

Environmental Services receives 311 tickets based on citizen complaints throughout the year identifying oil waste, antifreeze or other automobile waste being placed in a stormwater conveyance system (curb and gutter, back ditch, etc.). Clearly defined in the [Hampton City Code 33.2-26 \(b\)](#);

It shall be unlawful for any person to pour or discharge, or to permit to be poured or discharged, or to deposit, so that the same may be discharged, any gasoline, oil waste, antifreeze, or other automotive, motor, or equipment fluid into any storm sewer system.

Residents shall dispose of oil and automotive waste appropriately by taking them to automotive repair and sales businesses. Anyone violating this article will be notified in person, and given a copy of the code to educate about the violation. Repeat offenders can be pursued with enforcement.

Swimming Pool Discharge

Environmental Services receives 311 tickets based on citizen complaints throughout the year for swimming pool water being discharged in a stormwater conveyance system (curb and gutter, back ditch, etc.). Clearly defined in the [Hampton City Code 33.2-26 \(e\)](#);

It shall be unlawful for any person to discharge chlorinated swimming pool water into the stormwater system.

The use of chemicals designed to reduce or eliminate chlorine from your swimming pool water, or simply waiting for more than 10 days after the last treatment will naturally dechlorinate water. Residents may discharge their de-chlorinated swimming pool water legally, though the city still recommends that they discharge the pool water into a grassy area before entering the stormwater system to improve chances of infiltration. Anyone violating this article will be notified in person, and given a copy of the code to educate about the violation. Repeat offenders can be pursued with enforcement.

Bulk Trash & Construction Debris

Bulk limbs and construction debris, no larger than 5 inches in diameter and 5 feet in length, may be disposed of legally in the City of Hampton on the same day as your regular garbage when putting in a request through the 311 Call Center, or filling a form out on the website (<http://hampton.gov/index.aspx?nid=333>).

Environmental Services receives 311 tickets based on citizen complaints throughout the year for bulk trash or construction debris being placed in a stormwater conveyance system (curb and gutter, back ditch, etc.). Clearly defined in the **Hampton City Code 33.2-26 (d)**;

It shall be unlawful for any person to throw place, deposit, or cause to be thrown, placed or deposited, in any gutter, ditch, storm drain, or other drainage area in the city anything that impedes or interferes with free flow of stormwater therein.

Anyone violating this article will be notified in person, and given a copy of the code to educate about the violation. Repeat offenders can be pursued with enforcement.

PUBLIC WORKS SWPPP

As part of Hampton's agreement with the Environmental Protection Agency (EPA) and the Department of Environmental Quality (DEQ), the Stormwater Operations division created and implemented a Stormwater Pollution Prevention Plan (SWPPP) for the entire Public works compound. As part of the responsibilities that accompany such a plan, Environmental Services division conducts bi-annual outfall testing for illicit discharges. These samples are gathered and tested under the same protocols as all other illicit discharge parameters for the purpose of insuring Public Works SWPPP is functioning correctly and that no point source illicit discharges are occurring to the Bright's Creek outfall.

Another protocol implemented by the Stormwater Division is high priority inlet protection devices, which have been installed in key Public Works locations to capture both sediment and hydrocarbons, limiting illicit discharges to the stormwater system. There are two types of inserts:

- 1) Flowgard
- 2) Hydrokleen

Both capture and remove sediment and hydrocarbons, but the HydroKleen inserts have the capacity to capture heavy metals and phosphates as well. Also, the HydroKleen inserts allow for the Stormwater Inspectors to take grab samples for illicit discharge testing. These samples are considered "wet samples" and are taken during or after rain events to insure the HydroKleen filter pouches are functioning. All testing results can be found in the Stormwater Files and the Environmental Services office.

Record Keeping

Due to evolving regulations set forth by the EPA and DEQ, record keeping is an essential part of our program. Electronic and hard copy forms can be found on the city's Public Works Stormwater File, and in the Environmental Services office. Each Illicit Discharge visit should include an Illicit Discharge Field Sheet containing pertinent information, a GIS map showing existing stormwater assets, any requested information from the 311 call center (if applicable), and photos from the site visit. A copy of any and all documentation in hard copy form will be available in the Environmental Services office. All workflow can be tracked through the Lucity asset tracking program for Public Works.

The City of Hampton will notify Virginia Department of Transportation (VDOT) when an illicit discharge is identified in the VDOT MS4.

All findings are reported annually to the Stormwater Engineer for the Hampton Roads Planning District Committee (HRPDC) and DEQ.

Appendix A

Stormwater Code



Stormwater Literature

The Public Works Department wanted to stop by and let you know that the following item(s) pose not only a threat to the integrity of the City's Stormwater System but also a threat to the quality of water that is being discharged into the Chesapeake Bay. We ask that you would join us in preventing potential damage to your property, your neighbor's property through flooding and backing up infrastructure. Also by doing our part on land we can help the environment by properly disposing of the items marked below. Included below is our contact information and you can find attached a copy of the Stormwater Code Excerpts so that you can be aware of the potential fines/penalties for repeat offenses. Please feel free to contact us by using the City's 311 system. (757) 727-8311. Thank you.

- ☐ Grass clippings, leaves, limbs, yard waste etc.
- ☐ Petroleum products or derivatives of petroleum
- ☐ Sediment laden water
- ☐ Chlorinated water (Pool or otherwise)
- ☐ Bulk waste
- ☐ Paints or cleaning solvents
- ☐ Food or other human waste
- ☐ Other: _____

Department of Public Works

419 N. Armistead Avenue | Hampton, Virginia 23669
www.hampton.gov | P: (757) 727-8311



Chapter 33.2 - STORMWATER MANAGEMENT ORDINANCE EXCERPTS

(June 18, 2015)

.....

ARTICLE II. - STORMWATER MANAGEMENT PROGRAM

Sec. 33.2-23. - Enforcement.

(a) If the administrator determines that there is a failure to comply with the land-disturbing permit conditions or determines there is an unauthorized discharge, notice shall be served upon the permittee or person responsible for carrying out the permit conditions by any of the following methods: verbal warnings and inspection reports, consent special orders, and notices of violation including corrective action. Written notices shall be served by registered or certified mail to the address specified in the permit application or by delivery at the site of the development activities to the representative or employee supervising such activities.

(1) The notice shall specify the measures needed to comply with the permit conditions and shall specify the time within which such measures shall be completed. Upon failure to comply within the time specified, a stop work order may be issued in accordance with subsection (b) herein, or the administrator may revoke the permit.

(2) If a permittee fails to comply with a notice issued in accordance with this section within the time specified, the administrator may issue an order requiring the owner, permittee, person responsible for carrying out an approved plan, or the person conducting the land-disturbing activities without an approved plan or required permit to cease all land-disturbing activities until the violation of the permit has been satisfied, or an approved plan and required permits are obtained, and specified corrective measures have been completed.

Such orders shall be issued in accordance with the city's stormwater program inspection and enforcement manual. Such orders shall become effective upon service on the person by registered or certified mail, return receipt requested, sent to his address specified in the land records of the city, or by personal delivery by the administrator. However, if the administrator finds that any such violation is grossly affecting or presents an imminent and substantial danger of causing harmful erosion of lands or sediment deposition in waters within the watersheds of the state or otherwise substantially impacting water quality, without advance notice or hearing, it may issue an emergency order directing such person to cease immediately all land-disturbing activities on the site and shall provide an opportunity for a hearing, after reasonable notice as to the time and place thereof, to such person, to affirm, modify, amend, or cancel such emergency order. If a person who has been issued an order is not complying with the terms thereof, the administrator may institute a proceeding for an injunction, mandamus, or other appropriate remedy in accordance with subsection (c) herein.

(b) In addition to any other remedy provided by this chapter, if the administrator determines that there is a failure to comply with the provisions of this chapter, he may initiate informal and/or formal administrative enforcement procedures in a manner that is consistent with the city's stormwater program inspection and enforcement manual.

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(c) Any person violating or failing, neglecting, or refusing to obey any rule, regulation, ordinance, order, approved standard or specification, or any permit condition issued by the administrator may be compelled in a proceeding instituted by the city in the Hampton General District Court to obey the same and to comply therewith by injunction, mandamus, or other appropriate remedy.

(d) Any person who violates any provision of this chapter or who fails, neglects, or refuses to comply with any order of the administrator shall be subject to a civil penalty not to exceed \$32,500.00 for each violation within the discretion of the court. Each day of violation of each requirement shall constitute a separate offense.

(1) Violations for which a penalty may be imposed under this subsection shall include but not be limited to the following:

- a. No state permit registration;
- b. No SWPPP;
- c. Incomplete SWPPP;
- d. SWPPP not available for review;
- e. No approved erosion and sediment control plan;
- f. Failure to install stormwater BMPs or erosion and sediment controls;
- g. Stormwater BMPs or erosion and sediment controls improperly installed or maintained;
- h. Operational deficiencies;
- i. Failure to conduct required inspections;
- j. Incomplete, improper, or missed inspections; and
- k. Discharges not in compliance with the requirements of Section 9VAC25-880-70 of the general permit.

(2) The administrator may issue a summons for collection of the civil penalty, and the action may be prosecuted in the appropriate court.

(3) In imposing a civil penalty pursuant to this subsection, the court may consider the degree of harm caused by the violation and also the economic benefit to the violator from noncompliance.

(4) Any civil penalties assessed by a court as a result of a summons issued by the city shall be paid into the treasury of the city to be used for the purpose of minimizing, preventing, managing, or mitigating pollution of the waters of the city and abating environmental pollution therein in such manner as the court may direct.

(5) Notwithstanding any other civil or equitable remedy provided by this section or by law, any person who willfully or negligently violates any provision of this chapter, any order of the administrator, any condition of a permit, or any order of a court shall be guilty of a misdemeanor punishable by confinement in jail for not more than 12 months or a fine of not less than \$2,500 nor more than \$32,500.00, or both. Any such person furthermore shall be

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liable for all damage, loss, and expense suffered or incurred by the city as a result of such violation.

(6) In addition to any penalty imposed for a violation of the provisions of this chapter, a judge hearing the case may direct the person responsible for the discharge or deposit to remediate or remove such discharge or deposit; and each day's default in such remediation or removal shall constitute a separate violation under this section.

.....

ARTICLE III. - STORMWATER POLLUTION CONTROL

Sec. 33.2-26. - Pollution of the storm sewer system.

- (a) It shall be unlawful for any person to put, throw, place, or deposit or allow to be put, thrown, placed, or deposited any filth, animal or vegetable matter, chips, compost, construction debris, shavings, or any other substance or pollutant, whether solid or liquid, in the stormwater system or place or dispose of such material or substance in any area which drains into the stormwater system, or in any manner pollute the storm sewer system.
- (b) It shall be unlawful for any person to pour or discharge, or to permit to be poured or discharged, or to deposit, so that the same may be discharged, any gasoline, oil waste, antifreeze, or other automotive, motor, or equipment fluids into any storm sewer system.
- (c) It shall be unlawful for any commercial, industrial, or manufacturing entity to discharge process water, wash water, or any other unpermitted discharge into any storm sewer system.
- (d) It shall be unlawful for any person to throw, place, or deposit, or cause to be thrown, placed, or deposited, in any gutter, ditch, storm drain, or other drainage area in the city anything that impedes or interferes with the free flow of stormwater therein.
- (e) It shall be unlawful for any person to discharge chlorinated swimming pool water into the stormwater system.

Sec. 33.2-27. - Illicit discharges to the storm sewer system.

- (a) No person shall connect, or cause or permit to be connected, any sanitary sewer to the storm sewer system.
- (b) No person, either directly or indirectly, shall cause or permit any significant discharge to the city's storm sewer system that is not composed entirely of stormwater.
- (c) Subject to the provisions of subsection (d) herein, the following activities shall not be in violation of this ordinance:
 - (1) Water line flushing;
 - (2) Landscape irrigation;
 - (3) Diverted stream flows;
 - (4) Rising ground waters;
 - (5) Uncontaminated ground water infiltration (as defined at 40 CFR § 35.2005(20));
 - (6) Uncontaminated pumped ground water;

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- (7) Discharges from potable water sources;
 - (8) Foundation drains;
 - (9) Air conditioning condensation;
 - (10) Irrigation water;
 - (11) Springs;
 - (12) Water from crawl space pumps;
 - (13) Footing drains;
 - (14) Lawn watering;
 - (15) Individual residential car washing;
 - (16) Flows from riparian habitats and wetlands;
 - (17) De-chlorinated swimming pool discharges;
 - (18) Street wash water;
 - (19) Discharges or flows from fire fighting; and
 - (20) Any activity authorized by a valid Virginia Pollutant Discharge Elimination System ("VPDES") permit or Virginia Pollution Abatement ("VPA") permit.
- (d) In the event any of the activities listed in subsection (c) herein are found to be causing sewage, industrial wastes, or other wastes to be discharged into the storm sewer system, the director shall notify the person performing such activities and shall order that such activities be stopped or conducted in such manner as to avoid the discharge of sewage, industrial wastes, or other wastes into the storm sewer system. Failure to comply with any such order shall constitute a violation of the provisions of this ordinance.

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Appendix B

Weather Log

Hampton Illicit Discharge Detection and Elimination Worksheet

Weather Conditions Log

Date _____ Time _____ Field Supervisor _____

I. Weather Conditions:

- A. If rainfall was less than 0.1 inch for the previous 48-hour period, ***dry weather conditions*** exist, and sampling may proceed.
- B. If rainfall was more than 0.1 inch for the previous 48-hour period but less than 1 inch for a 24-hour period, a ***rainfall event*** has taken place and 48 hours must elapse prior to continuance of sampling.
- C. If rainfall was more than 1 inch for a 24-hour period, a ***storm event*** has taken place and 72 hours must elapse prior to sampling.

- II. Document current weather conditions and antecedent weather conditions. The previous 24-hour to 48-hour time frame is critical for determining if sampling will be conducted.

	Last Rainfall Date	Last Rainfall Amount	Time Since Rain Event
Wakefield National Weather Service via Langley Air Force Base			
Weather Channel Online			
WeatherLink Hampton @ Environmental Services			

pH / Temperature meter was calibrated by _____ on _____ at _____ .

Appendix C

IDDE Dry Weather Screening Field Sheet

HAMPTON DRY WEATHER SCREENING ILLCIT DISCHARGE FIELD SHEET

LOCATION: _____ DATE: _____

AREA / ZONE: _____ TIME: _____

OUTFALL /
STRUCTURE #: _____ INSPECTION
TEAM: _____

GENERAL INFORMATION:

Time since last rain: >72 hrs <72 hrs Quantity of last rain: >0.1 in. <0.1 in.

FIELD SITE AND STRUCTURE PHYSICAL DESCRIPTION

	Open Channel	Manhole	Outfall	Other _____	
Dominant Watershed Land Uses:	Industrial	Commercial	Residential	Unknown	Other _____
Deposits/Stains:	None	Sediments	Oily	Other _____	
Vegetation Condition:	None	Normal	Excessive Growth	Inhibited Growth	
Structural Condition:	Normal	Concrete Cracking/Spauling	Metal Corrosion	Other _____	
Biological:	Mosquito Larvae	Bacteria/Algae	Other _____		

FLOW ESTIMATION: Flow Observed? Yes No Approx. Channel Width or Pipe Diameter _____

If yes, complete these questions, make visual observations, and analyze:

- 1) Width of Water Surface _____ ft
- 2) Approx. Water Depth _____ ft
- 3) Approx. Flow Velocity _____ ft/sec
- 4) Flow Rate = $1 \times 2 \times 3 \times 448.8$ _____ gal/min

VISUAL OBSERVATIONS: Photo Taken? Yes No If yes, roll and photo # (if digital, photo #) _____

Odor:	None	Musty	Sewage	Rotten Eggs	Sour Milk	Other _____	
Color:	Clear	Red	Yellow	Brown	Green	Grey	Other _____
Clarity:	Clear	Cloudy	Opaque	Suspended Solids			
Floatables:	None	Oily Sheen	Garbage/Sewage	Other _____			

FIELD ANALYSIS: (complete only when flow is observed)

Water Temp:	_____ C	Phenol:	_____ mg/L	Nitrate:	_____ mg/L
pH:	_____ S.U.	Chlorine:	_____ mg/L	Phosphate:	_____ mg/L
Salinity:	_____ ppt	Ammonia:	_____ mg/L	Copper:	_____ mg/L

TIDAL EFFECTS:

Is outfall submerged (standing or flowing)? Yes No
If yes...how much? 1/4 1/2 3/4 Fully

Comments: _____

Completed By: (Signature) _____

Appendix D

Equipment Checklist

Revised Illicit Discharge Checklist

- Check and Document Recent Weather
- Secure IDDE Worksheets
- Calibrate pH meter (Daily)
- Confirm all testing equipment is cleaned
- Confirm all tests are stocked
- Check equipment is in working order
- Gather site location data
- Secure all equipment in work vehicle
- Perform vehicle safety check

Equipment Checklist

- Photometer 9500
- Photometer Tests
 - o Ammonia
 - o Chlorine
 - o Copper
 - o Nitrates
 - o pH
 - o Phenols
 - o Phosphates
- pH / Temperature Meter
- Sampling Rod and Collection Jar
- Collection Jars
- GPS Tracker
- Refractometer
- Gloves
- Goggles
- Stopwatch
- Deionized water
- Worksheet clipboard

Appendix E

Pollutant Information

Illicit Discharge Detection and Elimination

The Illicit Discharge Detection and Elimination (IDDE) program is designed to identify non-stormwater discharges into the waters of the U.S. This testing will be completed by a designated field supervisor and team chosen by the Division of Environmental Services. The testing parameters and rationale are listed below:

Ammonia – Ammonia is discharged in municipal, industrial, and agricultural wastewaters and is important because of its potential toxic qualities raising nitrogen levels and increasing acidification.

Chlorine – Chlorine found in high concentrations can indicate a leak in drinking water. It could also indicate in some circumstances industrial wastewater and swimming pool discharges.

Copper – High levels of copper indicate possible discharges from condensate or heat exchangers, which is highly toxic to aquatic life.

E. Coli and Fecal Coliforms – During dry weather conditions, high bacteria levels are most useful as an indicator of sewage in stormwater systems. However, during stormwater discharges bacteria levels can be high due to runoff that contains fecal waste from pets and other animals.

Nitrates – Nitrates are found in natural, drinking, and waste waters. An excessive amount of nitrates present can indicate a wastewater overflow, over-fertilization of green areas, or excessive animal waste being washed down into stormwater.

pH - Natural surface water generally has pH values ranging between six and nine, depending upon the presence of dissolved substances that come from bedrock, soils, photosynthetic activity, and other materials in the watershed. If the water in a stream is too acidic or basic, it may harm or kill aquatic life by directly disrupting biochemical reactions or it may indirectly affect aquatic life by increasing the toxicity of aqueous compounds. As pH increases, ammonia becomes more toxic to fish and as pH decreases, the concentration of a metal increases because higher acidity increases the ability of metals to be dissolved from sediments into base molecules, releasing into the water.

Phenols – Phenol levels may occur naturally, or in drinking and industrial wastewaters. High levels are toxic to aquatic life, and may indicate discharges from oil or chemical refining, breakdown of pesticides, human and animal wastes, or livestock runoff.

Phosphates – Phosphates have widespread applications, including detergent formulations, food processing, water treatment processing, agriculture fertilizers, and can occur naturally with breakdown of plant and animal wastes. Phosphates are associated with eutrophication of water and with rapid unwanted plant growth in rivers and lakes.

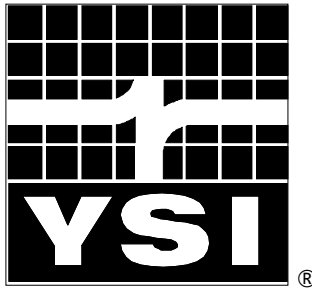
Salinity – Salinity levels may change depending on proximity to sea water, but may also change due to outside factors such as salting operations after snowfall, construction discharges, or building wash water. Salinity levels changing may be detrimental to aquatic life.

Temperature – Temperature outside of the normal, whether higher or lower, can indicate some form of illicit discharge and would warrant further investigation. Warmer temperatures directly affect the eutrophication process and may indicate the need for aeration.

The City of Hampton also utilizes Hampton Roads Sanitation District (HRSD) for Quality Assurance/Quality Control (QA/QC). Testing in the city yard will be done quarterly, and will be QA/QC a minimum of once annually.

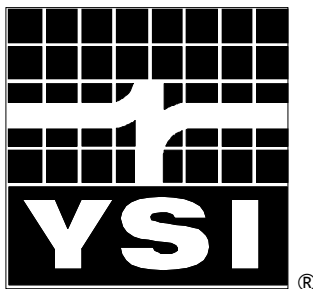
Appendix F

Photometer 9500 Instructions



YSI 9300 and 9500 Photometers

User Manual



YSI 9300 and 9500 Direct-Read Photometers User Manual

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1 INTRODUCTION

The YSI 9300 and 9500 direct-read photometers are designed to give long and trouble-free operation. To ensure the best results, please read this manual carefully and follow the procedures recommended. This manual covers both the 9300 and 9500 photometers. Therefore, some of the information only pertains to the 9500 as is noted in the appropriate sections.

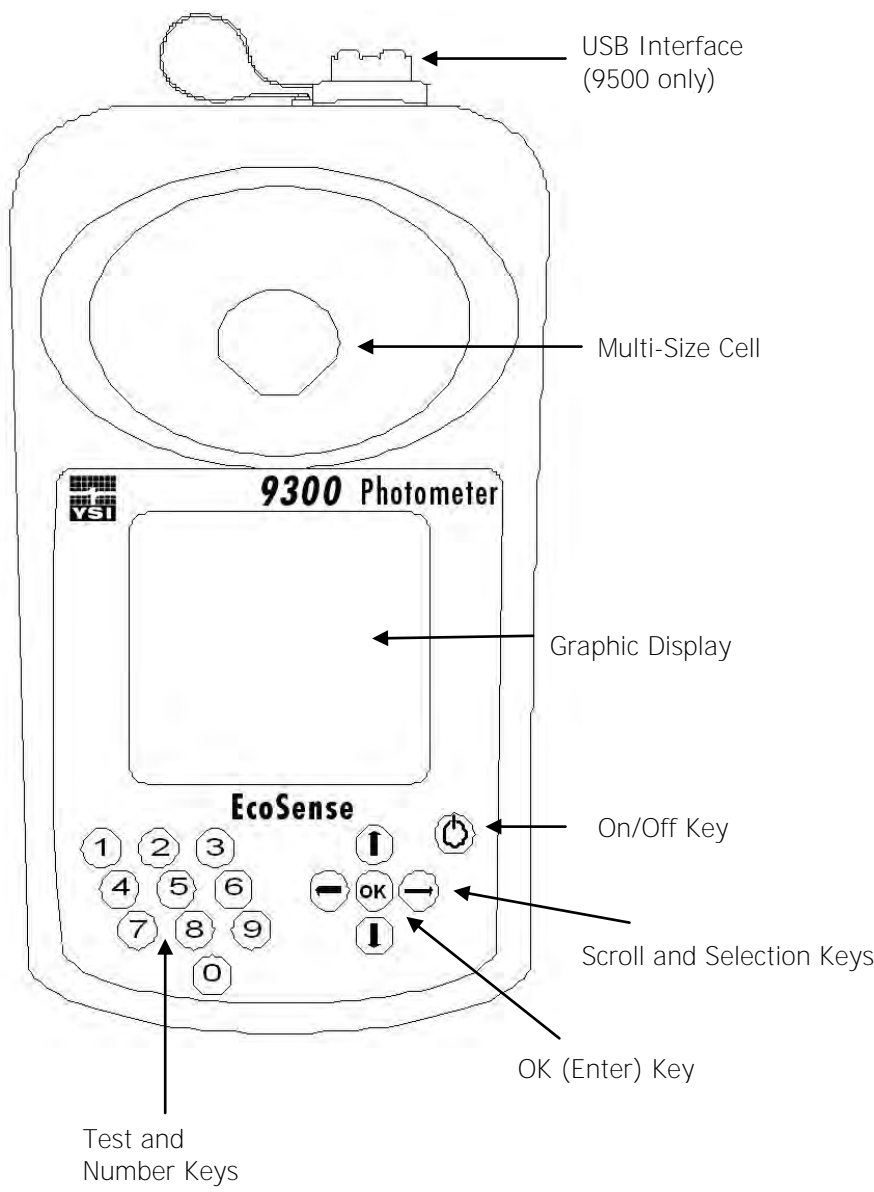
The Photometers feature digital electronics and built-in filters. It is lightweight and portable for field or laboratory use. The instruments are rugged, durable and IP-67 rated. Additionally, the photometers are direct-reading, have automatic blank setting, automatic wavelength selection, and automatic power cut-off.

The following pages describe the use of the photometers, and give instructions for the wide range of water tests which can be performed using these instruments.

Keep the photometer clean and in good working order by adhering to the following recommendations:

- Do not pour out samples or prepare the tests directly over the instrument.
- Always cap the test tubes before inserting into the instrument for readings.
- Wipe test tubes with a clean tissue to remove drips or condensation before placing in the photometer.
- Do not leave tubes standing in the photometer test chamber. Remove the tubes immediately after each test.
- Immediately wipe up any drips or spills on the instrument or in the test chamber with a clean tissue.
- Keep the instrument clean. Clean the test chamber regularly using a moistened tissue or cotton ball.
- Keep the instrument away from all chemicals and cleaning materials.
- Keep the instrument in a clean, dry place when it is not in use. Keep it on a clean, dry bench away from chemicals, place it in a storage cupboard or keep it in a carrying case.
- Keep the carrying case in a clean, dry condition. Make sure that the carrying case is dry before the case is closed up and the instrument is put away.

Instrument Layout



Features and Technical Specification

Application	For application in general water testing using Palintest tablet reagent systems and Palintest Tubetests reagents.
Instrument Type	Single-beam colorimeter with built-in colour filters and pre-programmed test calibrations.
Peak Wavelengths	445 \pm 5nm, 495 \pm 5nm, 555 \pm 5nm, 570 \pm 5nm, 605 \pm 5nm and 655 \pm 5nm
Range	1 - 100%T
Accuracy	\pm 1%T
Display	Large graphic display with option of backlight.
Language	Test identification and prompts in English, French, German, Spanish and Italian.
Timer	Clock and timer feature to log test results and audible alarm for timing test procedure.
Units	Direct-reading of test results in mg/l, ppm, g/l or molar units (mmol/l or μ mol/l).
User Selectable Options	10 digit sample number entry, dilution factor, time/date, date format, system lock and rounding of results.
Date Format	Date format selectable as day/month/year or month/day/year.
Zeroing	Automatic zeroing on blank tube and hold blank facility for series of tests. Continuation test facility without the need for reblanking.
Internal Memory	Stores 500 previous readings with option to view logged results on screen, or download to computer.
USB Interface	USB 1.1 full-speed, bus-powered device. Software selectable between either emulation of a removable hard-drive or emulation of a serial device connected via a virtual COM port.
Power	3 x 1.5V 'AA' alkaline batteries or via USB interface. Power management system with variable length auto switch-off or 'continuous' operation.
Size	250 x 150 x 70 mm
Weight	985 g (2.1 lbs)
Test Tubes	For tablet reagents - 10 ml glass test tubes, 20 mm OD (YPT 595).
Cell Holder	Multi-size tube holder accepts test tubes from 12 – 20 mm OD and centres the tube for optimum optical performance.

2 OPERATING PRINCIPLE

The YSI photometers are instruments that measure color intensity. Light is passed through a test tube containing the sample solution, and then through a colored filter onto a photodetector. Filters have been chosen so that light of a specific wavelength is selected. When the solution is completely colorless, all of the light passes through the sample. With colored samples, light is absorbed and the light which passes through the sample is proportionately reduced.

In the following test procedures, the photometer is used to measure the color which is produced when chemical reagents are reacted with the water sample. In these tests, the color intensity produced is proportional to the concentration of the parameter being tested.

The photometer is pre-programmed with calibrations for each test parameter. Different test procedures are carried out at different wavelengths to optimize the sensitivity of each test. The required wavelength is selected automatically by the instrument.

The calibrations are accessed by entering a unique program number at the start of each test procedure. This enables the instrument to select the appropriate wavelength filter automatically and allows the photodiode response to be converted to a concentration reading. The instrument thus displays a direct-reading of the test result.

The photometer is ideally suited for general analytical applications. The instrument can be used as a laboratory or field photometer with user-generated calibration graphs for standard analytical methods or for comparison of colored solutions.

For general analytical applications, Transmittance (test program 0), or Absorbance (test program 1) can be chosen.

Powering the Photometer

The Photometer is powered by (3) AAA batteries. The photometer features a battery indicator – see **'System Mode' functions**. **A minimum voltage of 3.0V** is needed to operate the photometer. As a power-saving measure, in normal use, both the 9300 and 9500 photometers automatically switch off five minutes after the last key is pressed. The switch off period may be adjusted for the 9500 in the System mode.

In addition to the above feature, a battery-warning message will appear automatically on the display when the battery voltage becomes low. The batteries should be replaced as soon as possible after the warning message appears. Stored data in the instrument memory will not be lost during battery replacement.

Replacing the Batteries

The battery compartment in the base of the instrument is secured by four screws. To replace the batteries, remove the cover and install the batteries, observing the correct polarity as indicated. Use 3 x 1.5V 'AA' alkaline batteries or equivalent. To avoid corrosion damage through leakage, remove batteries from the instrument if it is to be stored or left unused for a long period of time (> 30 days).

Power Supply (Model 9500 only)

The 9500 photometer can be powered either from alkaline batteries or via the USB socket. To use mains power, the instrument is connected using the USB Connection Cable (YPT 284) plugged to the Mains Adapter (YPT283). Alternatively, the USB connection cable can be plugged into a computer to power the 9500 from the computer.

3 GENERAL PHOTOMETER OPERATION

The photometer is controlled by a simple intuitive menu system:

- The highlight indicates the active line or section of the screen
- The ↑ and ↓ keys move the highlight through the menu choices
- The ↑ and ↓ keys allow selection of options
- **The flashing cursor in the 'Options' menu at the bottom of the screen** indicates the action which will occur if the [OK] button is pressed.

Operating Modes

The photometer has two distinct operating modes - the PHOTOMETER mode and the SYSTEM mode.

The PHOTOMETER mode is the normal operating mode for taking photometer readings. This mode is engaged automatically when the instrument is turned on by pressing the ⏻ key.

As a power-saving measure, in normal use, both the 9300 and 9500 photometers automatically switch off five minutes after the last key is pressed. This may be adjusted for the 9500 in the System mode.

The SYSTEM mode is used to set the system options. This mode is engaged when the photometer is turned on using the ⏻ key and then selecting 'System' using the ↑ and ↓ keys and pressing [OK].

Scroll through the menu box to view all the options available.

System - Quick Start

When the instrument is first used, the SYSTEM mode should be used to set the preferred operating options:

- Use the ↑ and ↓ keys to scroll through the features.
- Use the ↑ and ↓ keys to select the options.
- Press [OK] to accept the selections and return to PHOTOMETER mode.
- Select the desired language from English, French, German, Spanish or Italian.
- Select the desired display units from mg/l, ppm, mmol/l, μmol/l and g/l.
- Set the sample **number option to 'On' to allow the entry of a sample number** during normal photometer operation (model 9500 only).
- **Set the sample increment option to 'On' to automatically increase the sample number** (model 9500 only).

- Set the dilution factor to 'On' or 'Off'. If the dilution factor option is set to 'On', the instrument will allow the entry of a numerical factor which will be used in the calculation of the result displayed on the instrument (model 9500 only).
- Select the preferred date format. The date may be shown in either Day/Month/Year or Month/Day/Year (9500 only).
- To change the date and time, select the date and time line then key in correct setting using the numeric keys. To correct an error, use the **•** and **•** keys to move the cursor then key in the correct data (9500 only).

System - Full Options

The Photometer features a wide range of options which may be explored at leisure to get the best results from the instrument. An explanation of the application of these options is as follows:

View Log (9500 Only)

The 9500 photometer has an internal memory which can hold up to 500 test results. Once the memory is full, each new result overwrites the oldest entry.

Select 'View Log' to view stored results on screen. The **•** and **•** keys may be used to scroll through the list of stored results. The 'Options' menu offers several choices.

Select 'Clear' to empty the memory. Confirmation is requested to avoid accidentally erasing the data. Select 'Exit' to return to SYSTEM mode. Select 'Download' to transmit stored data to a PC. This option only appears if the USB mode is set to 'COM Port'. Refer to 'Interface Connection and Data Memory' for further information.

Back Light

The graphic display features a backlight to enhance the display contrast. This may be switched off to conserve power when working on battery power.

Language Options

The photometer can be operated in a number of different languages. When a particular language is selected, the test names and operating commands will appear in that language. Certain tests and unit options are provided in accordance with the conventions of particular countries and are only available when the photometer is switched to the language that particular country.

Units

The photometer offers the choice of result expressed in mg/l, ppm, mmol/l, μ mol and g/l.

Sample Number (9500 Only)

A unique number may be associated with each result record to identify it in the log. **If Sample Number 'On' is selected, the user is offered the choice of entering a number of up to 10 digits for each sample reading.** If this function is set to 'Off', a sample number is automatically allocated.

Sample Number Increment (9500 Only)

The sample number increment option may be used to determine whether the instrument does or does not automatically increment the sample number after each test. Incrementation of the sample number may be used when the instrument is used for carrying out a series of similar tests. Alternatively it may be preferable not to increment the number if typical use involves carrying out a number of different tests on the same sample.

Dilution Factor (9500 Only)

When samples are out of range for the test, a dilution procedure may be used. **If the dilution factor option is set to 'On', the instrument will allow entry of a numerical factor which will be used in the calculation of the result displayed and stored in the log.**

Date and Time (9500 Only)

The instrument records the date and time of each reading taken and associates this with the data record in the log. To correct the date and time on the internal clock, select the date and time display line.

Date Format (9500 Only)

The option of day/month/year or month/day/year date format is available.

Battery Level

A battery level indicator shows the power available. At least 3.0V is required for successful operation of the instrument.

Locking System Mode Settings (9500 Only)

It is possible to 'lock' the system settings so that these cannot be tampered with or altered accidentally during use. This is important, for example, where it is necessary to verify that tests have actually been carried out at a particular time or date, or where procedures always require the use of a sample number or dilution factor.

The instructions for locking the settings are not included in this manual; these are provided to photometer owners or system administrators on formal request to YSI's Technical Support department (environmental@ysi.com).

Rounding (9500 Only)

In the normal default setting, the photometer will round test results appropriately for the resolution of the test. The rounding applied differs for each parameter depending on the shape of the calibration curve. This ensures the optimum precision and accuracy of each test procedure. For normal purposes it is strongly recommended that the instrument be left in the default setting.

However, for certain analytical applications, it may be useful to switch off the rounding to display the result in unrounded form. This may be the case, for example, when carrying out statistical evaluations of test methods where it is necessary to use the data in calculation of standard deviation or distribution data.

Time-Out (9500 Only)

As a power-saving measure, in normal use, both the 9300 and 9500 photometers automatically switch off five minutes after the last key is pressed.

The 9500 photometer may be switched to 'Long' time-out which allows 15 minutes before shut-down or 'Off' which allows continuous use. This is particularly useful when powering the instrument through the USB interface.

Edit User Defined Tests (9500 Only)

Users may wish to develop their own test methods and store calibrations on the photometer. The 9500 has the facility to store up to 30 user-defined calibrations. See 'User Defined Tests' below for full instructions.

USB (9500 Only)

The USB interface allows communication between the instrument and a PC. There is a choice of two operating modes – Hard Drive and COM Port.

In Hard Drive mode, the instrument appears as a removable hard drive when connected to a PC. No additional software is required on computers running Windows 2000, ME or XP. A driver to use this option with Windows 98SE is available from YSI Technical Support Department (environmental@ysi.com).

In COM Port mode, the instrument behaves as if connected to the PC serial port via RS232. In this mode, the PC requires installation of a USB virtual COM Port driver, available from YSI Technical Support Department (environmental@ysi.com).

See the section on 'Interface Connections and Data Memory' below for full instructions.

4 INTERFACE CONNECTIONS AND DATA MEMORY (9500 ONLY)

Stored data can be accessed by recall to the instrument display (see 'View Log'). Alternatively, data can be accessed using a PC:

- Connect the instrument to the computer via the USB port, using any suitable USB cable, ie YPT 746
- Turn the instrument ON and select SYSTEM mode from the 'Options' menu
- Scroll to 'USB' and select either 'Hard Drive' or 'COM Port'.

'Hard Drive' – Once this option is selected, simply turning the instrument ON while it is connected to a PC will cause an extra hard drive containing the instrument files to appear on the PC. The log of test results is in text file: **'9500_LOG.txt'**. The other files shown on screen contain calibration and operating systems for use when upgrading the instrument and should not be accessed.

The log file can be copied from the instrument by dragging between windows. Once copied, the file can be opened with many text editors, word processors or spreadsheet programs.

Note: Deleting this file from the instrument's hard drive will clear the data from the instrument memory.

'COM Port' – Once this option is selected, data can be downloaded from the instrument to the PC:

- Open the 'Virtual COM Port – HyperTerminal' window on the computer
- In the instrument SYSTEM mode, scroll to 'View Log' and select 'Download'.
- The data from the log will appear on the PC screen and can be transferred to other PC applications or printed.

'Unplugged' – Note that the 'Hard Drive' or 'Com Port' may only be selected while the instrument is being powered via its USB port. If the instrument is running on batteries and is not connected to either a PC or a YPT783 external power supply, an 'Unplugged' message will be displayed instead of either 'Hard Drive' or 'COM Port'.

5 TAKING PHOTOMETER READINGS

The photometer is very simple to use. Screen prompts guide the user towards the test result. The following sections describe how to get the best results from the instrument.

Program Numbers and Test Instructions

Each test is identified by a separate program number or named key. Program numbers are shown in the test instruction sheets supplied in this manual. For some tests, a choice of different programs is offered in order to get the result in different forms (for example, for Nitrate - NO_3 or Nitrate Nitrogen - $\text{NO}_3\text{-N}$).

In certain tests, such as free chlorine and total chlorine, the test can be continued to a further stage. This is allowed for in the programming of the photometer. In these tests, once the result of the first stage is obtained, the **'Follow-On' option may be selected to progress the test to the next test stage** or stages. The result will be calculated automatically.

These continuation programs have their own program number for reference purposes although direct access to these programs may be restricted.

Sample Dilution (9500 Only)

The photometer has a sample dilution option. This enables a factor to be entered when samples have been diluted to bring them within the measuring range of the test. For example, if a five times dilution of a sample has been made, then a dilution factor of x5 should be entered. The photometer will multiply the observed result by this factor so that the correct result for the original sample is displayed.

This option may be used in conjunction with the YSI Dilution Tube (YPT 512) which enables dilutions of x2, x3, x4, x5 and x10 to be made. Higher dilution factors may be entered but are subject to the limitation of the number of digits available of the result display for each test. When the display capabilities are exceeded, the symbol [xxx] will appear on the result display. The sample should not be diluted prior to carrying out a pH test, or a Transmittance or Absorbance reading.

Blank and Sample Tubes

A BLANK TUBE is needed each time the photometer is used. This enables the instrument to be set automatically and compensates for any inherent color in the test sample. It is important therefore to understand the meaning of the term **'BLANK TUBE'**.

The BLANK TUBE is a test tube filled only with the water being tested only. It is important to use the actual water to be tested to provide a true comparison for the test results.

The term 'SAMPLE TUBE' is used to describe the tube containing the water sample to which the reagents have been added in accordance with the appropriate test instructions. This tube is used to take the photometer reading.

Light Cap

A light cap is provided with the photometer. This cap fits over the test chamber and prevents stray light reaching the photodiode.


It is NOT necessary to use the light cap when using the photometer indoors or under shaded outdoor light. The light cap should be used when working outside in strong sunlight. The light cap is also recommended when carrying out turbidity-based tests such as the cyanuric acid test, under bright or variable lighting conditions. Test instructions indicate when the light cap should be used.

Getting the Best Results

Success in obtaining accurate and consistent test results will depend on the care with which test procedures are carried out. Always follow the test instructions carefully and observe the stated standing periods and temperature conditions where applicable.

Wipe test tubes free from condensation before placing in the photometer. Test tubes should always be kept in a clean condition. Wash and dry the test tubes carefully after use. Dirty tubes may be soaked in a mild detergent solution if necessary. Tubes which become stained or scratched should be discarded and replaced.

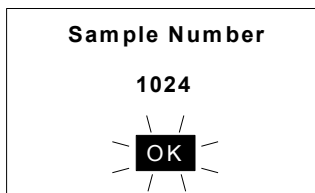
Taking Test Readings

Press  key. The instrument displays the 'Choose a Test' menu box, with the last test program used highlighted as the active line.

The cursor will flash on the [OK] symbol of the 'options menu' at the bottom of the screen. Press [OK] to accept this program.

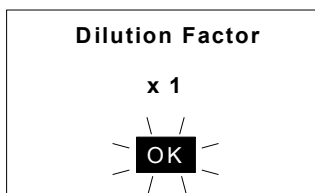
To choose a different test program, either use the ← and → keys to scroll through the menu options, or use the numeric keys to enter the Phot number of the desired test. The four most recently used tests are listed at the top of the 'Choose a Test' screen for convenience. Press [OK] to accept the selected program.

If the sample number option is pre-selected, then the following display will appear, for example (9500 only):



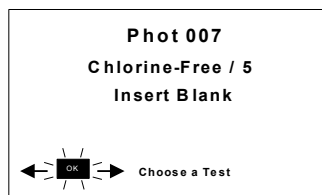
Enter or confirm the sample number (up to 10 digits), then press [OK].

- 1 If the dilution factor option is pre-selected, then the following display will appear (9500 only):



Press [OK] to accept the default value (x1, no dilution), or key in new dilution factor then press [OK].

- 2 The following display will now appear:

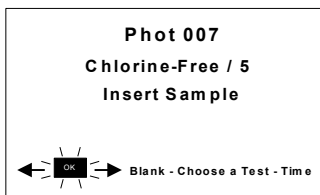


Place a BLANK TUBE in the test chamber, then press [OK].

NOTE: The instrument is designed to hold the blank setting as long as the instrument is switched on. This stage will be omitted when further tests are being carried out. However, when changing to a test which requires a colored or reagent blank, or uses a tube of a different diameter, a new **blank reading is required. The 'Insert Blank' prompt will be displayed automatically.**

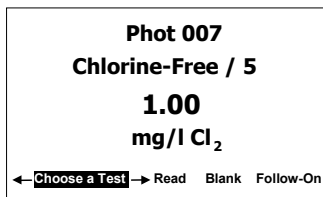
If the instrument is in used continuously, it is advisable to re-blank from time to time.

- 3 The instrument will be set automatically. After a few seconds the following display will appear:



Place SAMPLE TUBE in the test chamber, then press [OK].

- 4 The instrument will take the reading and display the result as follows, for example:



The following symbols indicate the result is out of test range:

Result is higher than range: >>

Result is lower than range: <<

- 5 The 'options menu' offers the choice to:

'Choose a Test' - return to the menu of test programs and select another test

'Read' - read further sample tubes of the currently selected test

'Blank' - re-blank the instrument

'Follow-On' - carry out a continuation test if available.

Continuation Tests (Certain Tests Only)

- 1 Select 'Follow-On' and press [OK] while the result is displayed of the currently running test. The photometer applies the previously entered sample number and dilution factor, and the 'Insert Sample' screen will appear.

Place SAMPLE tube in the test chamber, then press [OK].

- 2 The instrument will take the reading and calculate the result from the combination of readings (where appropriate). The result will be displayed as follows, for example:

Phot 008
Chlorine-Total / 5
1.50
mg/l Cl₂

Choose a Test Read Blank ← **Return** →

- 3 While the test result is displayed, similar options are available as at the end of a normal test program. In order to run more samples for the same parameters, select 'Return' from the 'options menu' to take the program back to the start of the first stage of a multiple test procedure.

Note: some continuation test procedures involve a standing period. The photometer may switch off automatically during this time. To avoid the instrument switching off, set for continuous operation or use the timer function to time any standing period. See Timer section. The timer will over-ride the auto switch off function.

Favorite Tests List

The four most recently used tests are listed at the top of the 'Choose a Test' screen for convenience.

Expressing Different Chemical Forms

If the test result can be expressed in different chemical forms, the chemical symbol will have flashing ↑ and ↓ to indicate this. Use the ↑ and ↓ keys to step through the options available.

Note that the log stores the result in the primary form.

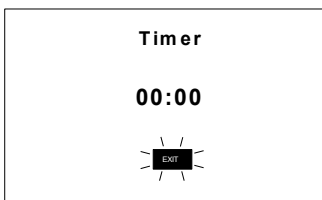
Reading in Transmittance and Absorbance

When taking readings in Transmittance or Absorbance mode, use the ↑ and ↓ keys to step through the wavelengths until the required wavelength is reached.

Timer

The photometer features a countdown timer with alarm as an aid to carrying out test procedures. The timer can be accessed at any time by selecting 'Timer' from the 'Options' menu.

The following display will appear:



Key in the time required in minutes and seconds using the numerical keys, then press [OK] to start the timer. The maximum time is 29 minutes and 59 seconds. Use the ← and → keys to reposition the cursor and re-enter the time if it is keyed in incorrectly.

The timer will count down, giving an audible alarm at the end of the timed period. Press [OK] to stop the alarm.

During the timer countdown period, an 'Options' menu is available :

- Stop - used to abort the timing operation or to stop the alarm at the end of the timed period
- Exit - used to return to the program screen to take readings. The timer will continue to run and give an audible alarm at the end of the period.
- Exit and Read - used to return to the program screen with the timer counting down on screen. The instrument will automatically take a reading at the end of the timed period and no alarm will sound.

User Defined Tests (9500 Only)

Users may wish to develop their own test methods and store the calibration data on the 9500. This will allow direct reading of user tests. The 9500 has the facility to store up to 30 user-defined calibrations.

To program user-defined calibrations:

Turn the instrument 'ON', select 'System' menu and press [OK]. Scroll through the options to the USB entry and make sure the option is set to 'Com Port'.

At the PC, open the HyperTerminal connection for the 9500 (contact YSI Technical Support Department to receive the virtual comport drivers for installation to PC).

At the instrument, in the 'System' menu, select 'Edit User Defined Tests' and press [OK]. The instrument will display the tests already downloaded, or show 'LIST EMPTY'.

In the 'Options' menu, select [Add] to add a new test, or [Edit] to edit the test which is currently highlighted. Change the highlighted test with **▪ and ▪ keys**. Press [OK].

The instrument displays a message box instructing the user to download the new or edited test file.

At the PC, download the calibration file from HyperTerminal using 'Transfer', 'Send Text File' and select the file to be downloaded.

The instrument will check the downloaded data. If it is acceptable, it will **display a message box 'Accepted' over the downloaded data.** If there are errors in the file, a list of errors will be displayed. The user should edit the calibration file to correct the errors then re-send it.

Press [OK] to accept the test. The instrument will change to the 'User Test List' screen (See 3), with a summary of the test displayed. Press [OK] to accept the test and write to memory. Select [Cancel] at any time to reject the calibration.

The format of the user calibration file is as follows: -

- **The file must start with 'USER CALIBRATION' and end with 'END'.**
- Test Number must be between 900-929 (30 tests).
- Test name, up to 18 characters.
- Units. Must be one of the following - mg/l, ppm, mmol/l, $\mu\text{mol/l}$ or g/l.
- Wavelength. Must be one of the following – 450 nm, 500 nm, 550 nm, 570 nm, 600 nm or 650 nm.
- Chemical symbols: up to 8 characters.
- Data pairs. Up to 10 pairs of data in the form :-
ABSORBANCE x.xxx, CONCENTRATION
(Concentration may be up to five digits).

An example is shown below:

USER CALIBRATION

900

Chlorine

mmol/l

500nm

Cl₂

0,0

0.174,0.50

0.481,1.50

0.733,2.50

0.854,3.00

1.022,4.00

1.086,4.50

1.187,5.00

END

6 CARE AND MAINTENANCE

The photometer is designed to give long and trouble-free operation. Care must be taken, however, to avoid test solutions being spilt over the instrument, and to prevent contamination of the instrument. Spillages or moisture should be wiped off immediately with a dry cloth. Never use solvents or abrasive materials to clean the instrument. Care should be taken to keep the test chamber clean.

Cleaning the Optics

Any build-up of dirt or deposits may interrupt light transmission and affect readings.

To clean the optics, undo the two screws to remove the optics base plate. Gently clean the internal surfaces of the optics with a soft, non-abrasive cloth. Deposits may be removed with a slightly dampened cotton bud. Replace the optics base plate and re-fasten the screws.

The photometer is fitted with long-life light sources and contains no user-serviceable components. If the instrument requires servicing or repair, contact YSI Technical Support Department.

Service Requirement

Servicing of the photometer is essential to ensure optimum performance. To arrange service of the instrument, contact YSI Technical Support Department or the authorized distributor who supplied the instrument. The YSI standard photometer service includes cleaning of the optical assembly, replacement of any worn parts and checking/recalibration of the instrument.

Error Messages

The photometer will display an error message in the unlikely event of a malfunction. These error messages are mainly designed to assist service staff in diagnosing instrument faults. In the event an error message appears on the photometer, contact YSI Technical Support Department for advice.

Error messages are coded 7 and 9 and both relate to blanking the instrument. If you see one of these error messages, check the operating technique and sample clarity. If you continue to get error messages, try the following:

Error 7 indicates too much light – remove the instrument from bright light and use the light cap.

Error 9 indicates not enough light – follow 'Cleaning the Optics' routine.

Photometer Up-Grade (9500 only)

It is now possible to upgrade the photometer with new test calibrations using a computer. This will ensure that users can always keep the instrument up-to-date with the latest tests. Contact YSI to request an update at environmental@ysi.com. No special computer software is required. Full instructions will be supplied with the upgrade data.

Computer Controlled Operation (9500 Only)

The photometer can be controlled from a computer using suitable control software. Such software is available from software houses or from water treatment specialists to cover specific applications. These software programs typically instruct the photometer to go through a predetermined series of tests specific to that application, and then automatically receive data from the photometer and process the test results. The internal software of the photometer is able to receive computer commands to start new sample, receive test program number, receive sample number and instigate continuation test. Programmers requiring further details should contact YSI Technical Support.

Warranty

The YSI photometers are warranted for one (1) year from date of purchase by the end user against defects in materials and workmanship, exclusive of batteries and any damaged caused by defective batteries. Within the warranty period, YSI will repair or replace, at its sole discretion, free of charge, any product that YSI determines to be covered by this warranty.

To exercise this warranty, write or call your local YSI representative, or contact YSI Customer Service at +1 937-767-7241 (800-897-4151). Send the product and proof of purchase, transportation prepaid, to the Authorized Service Center selected by YSI. Repair or replacement will be made and the product returned, transportation prepaid. Repaired or replaced products are warranted for the balance of the original warranty period, or at least 90 days from date of repair or replacement.

Limitation of Warranty

This Warranty does not apply to any YSI product damage or failure caused by:

- 1 Failure to install, operate or use the product in accordance with YSI's written instructions;
- 2 Abuse or misuse of the product;
- 3 Failure to maintain the product in accordance with YSI's written instructions or standard industry procedure;
- 4 Any improper repairs to the product;
- 5 Use by you of defective or improper components or parts in servicing or repairing the product;
- 6 Modification of the product in any way not expressly authorized by YSI.

THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. YSI's LIABILITY UNDER THIS WARRANTY IS LIMITED TO REPAIR OR REPLACEMENT OF THE PRODUCT, AND THIS SHALL BE YOUR SOLE AND EXCLUSIVE REMEDY FOR ANY DEFECTIVE PRODUCT COVERED BY THIS WARRANTY. IN NO EVENT SHALL YSI BE LIABLE FOR ANY SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES RESULTING FROM ANY DEFECTIVE PRODUCT COVERED BY THIS WARRANTY.

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Direct-Reading Photometer Program Schedule

TABLET REAGENT SYSTEM

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		Copper – Total	Continuation test* (Phot 11)
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PHOT.14.	Fluoride	Fluoride	Phot 14
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Instruction Sheet Number	Reagent System	Parameter	Photometer Program Number
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		Organophosphonate	Continuation test* (Phot 45)
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		Ozone	Continuation test* (Phot 26)
PHOT.27.	pH Value	pH – Phenol Red	Phot 27
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PHOT.31.	Silica LR	Silica	Phot 31
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		Zinc	Continuation test* (Phot 36)

*Continuation tests cannot be accessed directly

**PHOTOMETER TEST INSTRUCTIONS**

AMMONIA

TEST FOR AMMONIA IN NATURAL, DRINKING AND WASTE WATERS

Photometer Method**AUTOMATIC
WAVELENGTH
SELECTION****0 – 1.0 mg/l N**

Ammonia occurs as a breakdown product of nitrogenous material in natural waters. It is also found in domestic effluents and certain industrial waste waters. Ammonia is harmful to fish and other forms of aquatic life and the ammonia level must be carefully controlled in water used for fish farms and aquariums. Ammonia tests are routinely applied for pollution control on effluents and waste waters, and for the monitoring of drinking water supplies.

The YSI Ammonia Test provides a simple method of measuring ammonia (ammoniacal nitrogen) over the range 0 - 1.0 mg/l N.

Method

The YSI Ammonia test is based on an indophenol method. Ammonia reacts with alkaline salicylate in the presence of chlorine to form a green-blue indophenol complex. Catalysts are incorporated to ensure complete and rapid color development. The reagents are provided in the form of two tablets for maximum convenience. The test is simply carried out by adding one of each tablet to a sample of the water.

The intensity of the color produced in the test is proportional to the ammonia concentration and is measured using a YSI Photometer.

Reagents and Equipment

YSI Ammonia No 1 Tablets

YSI Ammonia No 2 Tablets

YSI 9300 or 9500 Photometer

Round Test Tubes, 10 ml glass (PT 595)

Test Instructions

- 1 Fill test tube with sample to the 10 ml mark.
- 2 Add one Ammonia No 1 tablet and one Ammonia No 2 tablet, crush and mix to dissolve.
- 3 Stand for 10 minutes to allow color development.
- 4 Select Phot 4 on photometer to measure Ammonia mg/l N **or** select Phot 62 on photometer to measure ammonium mg/l NH_4 .
- 5 Take photometer reading in usual manner (see photometer instructions).

Sea Water Samples

YSI Ammonia Conditioning Reagent is required when testing sea water or brackish water samples to prevent precipitation of salts. The reagent is supplied **in a special 'spoon pack' to aid measuring out the powder.**

Fill the test tube with sample to the 10 ml mark, and add one level spoonful of conditioning reagent. Mix to dissolve reagent then continue the test as described in the above test instructions. If turbidity still forms in the test, repeat using two level spoonfuls of conditioning reagent.

Notes

- 1 At low temperatures the rate of color development in the test may be slower. If the sample temperature is below 20°C allow 15 minutes for the color to develop.
 - 2 Ammonia concentrations can be expressed in a number of different ways. The following factors may be used for the conversion of readings :-
 - To convert from N to NH_4 multiply by 1.3.
 - To convert from N to NH_3 multiply by 1.2.
-

**PHOTOMETER TEST INSTRUCTIONS**

CHLORINE (DPD)

TEST FOR FREE, COMBINED AND TOTAL CHLORINE IN WATER

Photometer Method**AUTOMATIC
WAVELENGTH
SELECTION****0 – 5.0 mg/l**

Chlorine and chlorine-release compounds are widely used for the disinfection of drinking water and swimming pools, for the control of micro-biological growth in cooling water, and in many other water treatment systems. Accurate measurement of the chlorine residual is an essential aspect of the control of these chlorination processes.

The chlorine level can be expressed in terms of the free chlorine, combined chlorine or total chlorine residuals. For the majority of applications measurement of the free chlorine residual is the most important. The YSI DPD chlorine method provides a simple means of measuring free, combined and total chlorine residuals over the range 0 - 5 mg/l.

It is recommended that if any shock treatment compounds are known to have been used in the treatment of the water to be tested, that a DPD Oxystop tablet be included in the test procedure as outlined below.

Method

This YSI chlorine test uses the DPD method developed by Dr A T Palin and now internationally recognised as the standard method of testing for chlorine and other disinfectant residuals. In the YSI DPD method the reagents are provided in tablet form for maximum convenience and simplicity of use.

Free chlorine reacts with diethyl-p-phenylene diamine (DPD) in buffered solution to produce a pink coloration. The intensity of the color is proportional to the free chlorine concentration. Subsequent addition of excess potassium iodide induces a further reaction with any combined chlorine present. The color intensity is now proportional to the total chlorine concentration; the increase in intensity represents the combined chlorine concentration. In this way it is possible to differentiate between free and combined chlorine present in the sample. The color intensities are measured using a YSI Photometer.

The DPD Oxystop tablet is added after measurement for free chlorine but before the DPD No 3 tablet. It prevents the reaction between shock treatment chemicals and potassium iodide which would give a positive response.

Reagents and Equipment

YSI DPD No 1 Tablets
YSI DPD Oxystop Tablets (Optional)
YSI DPD No 3 Tablets
YSI 9300 or 9500 Photometer
Round Test Tubes, 10 ml glass (PT 595)

Separation of Chlorine Residuals

The photometer is programmed for both free and total chlorine. Use program Phot 7 Free Chlorine, then select the **'Follow On' option on screen to continue test** for program Phot 8 Total Chlorine.

Test Instructions

- 1 Rinse test tube with sample leaving two or three drops of sample in the tube.
- 2 Add one DPD No 1 tablet, crush tablet and then fill the test tube with sample to the 10 ml mark. Mix to dissolve tablet.
- 3 Select Phot 7 on photometer.
- 4 Take photometer reading **immediately** (as result may drift on standing), in usual manner - see photometer instructions.
- 5 The result represents the free chlorine residual as milligrams per litre. Stop the test at this stage if only **free chlorine** determination is required.
- 6 If it is desired to measure combined or total chlorine residual continue the **test on the same test portion. Select the 'Follow On' from screen options to** continue the test program.
- 7 If shock treatment chemicals are present in the pool, add one DPD Oxystop tablet, crush and mix to dissolve. Stand for one minute before proceeding.
- 8 Add one DPD No 3 tablet, crush and mix to dissolve.
- 9 Stand for two minutes to allow full color development.
- 10 Take photometer reading.
- 11 The result represents the **total chlorine** residual as milligrams per litre.
- 12 The **combined chlorine** residual is obtained by subtracting the free chlorine residual result from the total chlorine residual result :-

ie Combined Chlorine = Total Chlorine - Free Chlorine

Note: A too high chlorine level (above 10 mg/l) can cause bleaching of the pink coloration formed in the DPD test and give a false negative or lower than expected result. If a colorless or pale pink test solution is obtained, then a high level chlorine may be present, check for the possibility of bleaching by repeating the test on a sample diluted with chlorine-free water.

**PHOTOMETER TEST INSTRUCTIONS**

COPPER (COPPERCOL)

**TEST FOR FREE, CHELATED AND
TOTAL COPPER IN NATURAL
AND TREATED WATERS**

Photometer Method

**AUTOMATIC
WAVELENGTH
SELECTION**

0 – 5.0 mg/l

Copper occurs naturally in many waters and may also result from corrosion of pipes and fittings. The presence of copper in drinking water can give rise to discoloration or an astringent taste.

Chelated copper compounds are extensively used as algicides in swimming pool water, home aquariums and other waters. Electrolytic devices which generate copper and silver ions are used in the purification of swimming pool water.

The YSI Coppercol method provides a simple means of measuring copper in natural and treated waters over the range 0 - 5 mg/l. The test is particularly useful since it can be used to measure specifically the concentrations of free and chelated copper present in the water.

Method

In the YSI Coppercol method copper salts are reduced to the cuprous form and then reacted with a 2,2 Biquinoline-4,4-dicarboxylic salt to form a purple colored complex. This provides a measure of the free copper ions present in the sample. In the second stage of the test, a decomplexing agent is introduced and this induces a further reaction with any chelated copper compounds which might be present.

The reagents are provided in tablet form and the test is simply carried out by adding tablets to a sample of the water. The intensity of color produced in the test is proportional to the copper concentrations and is measured using a YSI Photometer.

Reagents and Equipment

YSI Coppercol No 1 Tablets

YSI Coppercol No 2 Tablets

YSI 9300 or 9500 Photometer

Round Test Tubes, 10 ml glass (PT 595)

Separation of Copper Residuals

The direct-reading photometer is programmed for both free and total copper. Use program **Phot 10 Free Copper**, then select the 'Follow On' option on screen to continue test for program **Phot 11 Total Copper**.

Test Procedure

- 1 Fill test tube with sample to the 10 ml mark.
- 2 Add one Coppercol No 1 tablet, crush and mix to dissolve.
- 3 Select Phot 10 on photometer.
- 4 Take photometer reading in usual manner - see photometer instructions.
- 5 The result represents the free copper concentration as mg/l Cu. Stop the test at this stage if only free copper determination is required.
- 6 If it is desired to measure chelated or total copper continue the test on the **same test portion. Select the 'Follow On'** from screen options to continue the test program.
- 7 Add one Coppercol No 2 tablet, crush and mix to dissolve.
- 8 Take photometer reading.
- 9 The result represents the **Total Copper** concentration as mg/l Cu.
- 10 The **Chelated Copper** concentration is obtained by subtracting the free copper concentration from the total copper concentration :-

$$\text{ie Chelated Copper} = \text{Total Copper} - \text{Free Copper}$$

**PHOTOMETER TEST INSTRUCTIONS**

NITRATE (NITRATEST)

TEST FOR NITRATE IN NATURAL, DRINKING AND WASTE WATERS

Photometer Method AUTOMATIC WAVELENGTH SELECTION

**0 – 1 mg/l N
0 – 20 mg/l N**

Nitrates are normally present in natural, drinking and waste waters. Nitrates enter water supplies from the breakdown of natural vegetation, the use of chemical fertilisers in modern agriculture and from the oxidation of nitrogen compounds in sewage effluents and industrial wastes.

Nitrate is an important control test for water supplies. Drinking waters containing excessive amounts of nitrates can cause methaemoglobinaemia in bottle-fed infants (blue babies). The EEC has set a recommended maximum of 5.7 mg/l N (25 mg/l NO_3) and an absolute maximum of 11.3 mg/l N (50 mg/l NO_3) for nitrate in drinking water.

The YSI Nitratest method provides a simple test for nitrate nitrogen over the range 0 - 1 mg/l N. The test can however be extended to cover the range 0 - 20 mg/l by a simple dilution technique.

Method

In the YSI Nitratest method nitrate is first reduced to nitrite, the resulting nitrite is then determined by a diazonium reaction to form a reddish dye.

The reduction stage is carried out using the unique zinc-based Nitratest Powder, and Nitratest Tablet which aids rapid flocculation after the one minute contact period. The test is conducted in a special Nitratest Tube - a graduated sample container with hopper bottom to facilitate settlement and decanting of the sample.

The nitrite resulting from the reduction stage, is determined by reaction with sulphanilic acid in the presence of N-(1-naphthyl)-ethylene diamine to form a reddish dye. The reagents are provided in a single Nitricol tablet which is simply added to the test solution.

The intensity of the color produced in the test is proportional to the nitrate concentration and is measured using a YSI Photometer.

Reagents and Equipment

YSI Nitratest Powder (Spoon Pack)

YSI Nitratest Tablets

YSI Nitricol Tablets

YSI Nitratest Tube, 20 ml (PT 526)

YSI 9300 or 9500 Photometer

Round Test Tubes, 10 ml (PT 595)

Test Procedure

- 1 Fill the Nitratest Tube with sample to the 20 ml mark.
- 2 Add one level spoonful of Nitratest Powder and one Nitratest tablet. Do not crush the tablet. Replace screw cap and shake tube well for one minute.
- 3 Allow tube to stand for about one minute then gently invert three or four times to aid flocculation. Allow tube to stand for two minutes or longer to ensure complete settlement.
- 4 Remove screw cap and wipe around the top of the tube with a clean tissue. Carefully decant the clear solution into a round test tube, filling to the 10 ml mark.
- 5 Add one Nitricol tablet, crush and mix to dissolve.
- 6 Stand for 10 minutes to allow full color development.
- 7 Select Phot 23 on photometer for result as mg/l N, or Phot 63 for result as mg/l NO_3 .
- 8 Take photometer reading in usual manner (see photometer instructions).

NOTE

To convert mg/l N to mg/l NO_3 multiply result by 4.4.

Concentrations of nitrate greater than 1.0 mg/l may be determined by diluting the original sample with deionised water. The test can be conveniently carried out over a range 0 - 20 mg/l N as follows :-

Take a clean Nitratest Tube. Add 1 ml of sample using a pipette or graduated dropper. Fill the Nitratest Tube to the 20 ml mark with deionised water. Continue the test procedure as given in steps 2 to 9 above. Multiply the chart reading obtained by 20 to obtain the nitrate concentration in the original sample.

Nitrite Correction

The Nitratest method will also respond to any nitrite present in the sample. In most natural and drinking waters the amount of nitrite will be small in comparison to the nitrate concentration. If it is desired to correct for nitrite, determine nitrite concentration (as mg/l N) in the prescribed manner (see PHOT.24.) and deduct from the nitrate concentration (as mg/l N) obtained from the Nitratest procedure.



PHOTOMETER TEST INSTRUCTIONS

pH (PHENOL RED)

TEST FOR pH VALUE OF WATER AND AQUEOUS SOLUTIONS

Photometer Method

AUTOMATIC WAVELENGTH SELECTION

6.8 – 8.4

pH measurement is one of the tests most frequently carried out on water and aqueous solutions. The phenol red indicator method provides a simple colorimetric means of pH determination for neutral and slightly alkaline waters over the range 6.8 - 8.4 units. The Phenol Red pH test is particularly applicable to testing swimming pools and spas.

Method

The YSI Phenol Red test uses a tablet reagent containing the precise amount of phenol red indicator required for the test. Phenol red reacts in water at different pH values over the range 6.8 - 8.4 to produce a distinctive range of colors from yellow to red. The color of the test solution is indicative of the pH value and is measured using a YSI Photometer.

Phenol red tablets contain a dechlorinating agent so that the test can be carried out in water containing normal levels of chlorine or other disinfectant residuals.

Reagents and Equipment

YSI Phenol Red Clear Tablets

YSI 9300 or 9500 Photometer

Round Test Tubes, 10 ml glass (PT 595)

Test Procedure

- 1 Fill test tube with sample to the 10 ml mark.
- 2 Add one Phenol Red tablet, crush and mix to dissolve.
- 3 Select Phot 27 on photometer.
- 4 Take photometer reading in usual manner (see photometer instructions).

Notes

- 1 The color range of the phenol red test is yellow, through orange, to red. The formation of an intense purple coloration shows that the indicator has been affected by high chlorine or other disinfectant residuals. In such cases the result should be disregarded.
 - 2 Phenol red does not show any further color change at pH values below 6.8 or above 8.4. Note therefore that when such values are recorded this could indicate that the sample has a much lower or much higher pH value.
 - 3 Ionic strength, temperature and other water factors may have an effect on pH readings. This test has been calibrated for conditions most likely to be encountered in a typical swimming pool at 30°C.
-

**PHOTOMETER TEST INSTRUCTIONS**

PHENOL (PHENOLTEST)

TEST FOR PHENOL AND ORTHO/ META SUBSTITUTED PHENOLS IN NATURAL, DRINKING AND INDUSTRIAL WASTE WATERS

Photometer Method**AUTOMATIC
WAVELENGTH
SELECTION****0 – 5.0 mg/l as Phenol**

Phenols and substituted phenols may occur in natural, drinking and industrial waste waters. Phenols are not readily removed from water by conventional water treatment processes. These compounds arise typically from oil and chemical refining, livestock dips, the breakdown of pesticides, human and animal wastes and from naturally occurring sources. Chlorination of such waters may produce odorous and objectionable-tasting chlorophenols.

The YSI Phenoltest method provides a simple means of measuring the concentration of phenol and phenolic compounds present in water over the range 0 - 5.0 mg/l. The concentration of phenol determined in the test is due to unsubstituted and to ortho and meta substituted phenols. A proportion of para substituted phenols will give a positive response.

Method

In the Phenoltest method, phenol and phenolic compounds react with 4-amino-antipyrine in the presence of ferricyanide ions to form a red color. The reagents are provided in tablet form and the test is carried out simply by adding the appropriate tablets to a sample of the water. A further tablet reagent is used to prevent interference due to metal ions.

The intensity of the red color produced in the test is proportional to the concentration of phenolic compounds present in the sample and is measured using a YSI Photometer.

Reagents and Equipment

YSI Phenoltest No 1 Tablets

YSI Phenoltest No 2 Tablets

YSI Phenoltest PR Tablets

YSI 9300 or 9500 Photometer

Round Test Tubes, 10 ml glass (PT 595)

Test Procedure

- 1 Fill round test tube to the 10 ml mark with sample.
- 2 In the case of samples known to contain copper, zinc, iron or manganese ions, add one Phenoltest PR tablet. Crush and mix to dissolve.
- 3 Add one Phenoltest No 1 tablet, crush and mix to dissolve.
- 4 Add one Phenoltest No 2 tablet, crush and mix to dissolve.
- 5 Stand for 10 minutes to allow full color development.
- 6 Select Phot 54 on the photometer.
- 7 Take photometer reading in the usual manner (see photometer instructions).
- 8 The result is displayed as mg/l C_6H_5OH .

Interferences

- 1 Use of the Phenoltest PR tablet will prevent interference from metal ions up to a concentration of 350 mg/l. The test is unaffected by free chlorine in the sample up to 10 mg/l.
 - 2 Low results may be obtained in samples containing more than 150 mg/l alkalinity (as $CaCO_3$), 10 mg/l sulphite or 2 mg/l sulphide. Certain organic keto-enol compounds may cause high results. In the case of known or suspected interferences, then the sample should be pre-treated in accordance with standard analytical procedures.
-

**PHOTOMETER TEST INSTRUCTIONS**

PHOSPHATE LR

TEST FOR LOW LEVELS OF PHOSPHATE IN NATURAL AND DRINKING WATERS

Photometer Method

AUTOMATIC WAVELENGTH SELECTION

0 – 4.0 mg/l PO₄**0 – 1.3 mg/l P**

Phosphates are extensively used in detergent formulations and washing powders. Phosphates also find widespread application in the food processing industry and in industrial water treatment processes. Agricultural fertilizers normally contain phosphate minerals and phosphates also arise from the breakdown of plant materials and in animal wastes.

Phosphates can therefore enter water courses through a variety of routes - particularly domestic and industrial effluents and run-off from agricultural land. Phosphate is an important control test for natural and drinking waters.

Whilst phosphates are not generally considered harmful for human consumption, they do exhibit a complex effect on the natural environment. In particular phosphates are associated with eutrophication of water and with rapid unwanted plant growth in rivers and lakes. Phosphates present in natural water pass through into drinking water supplies.

The YSI Phosphate LR test provides a simple method of measuring phosphate levels over the range 0 - 4 mg/l PO₄. For drinking water the EEC has set a guide level of 0.5 mg/l PO₄ (0.4 mg/l P₂O₅) and a maximum admissible concentration of 6.7 mg/l PO₄ (5 mg/l P₂O₅).

Method

In the YSI Phosphate LR method, the phosphate reacts under acid conditions with ammonium molybdate to form phospho-molybdic acid. This compound is **reduced by ascorbic acid to form the intensely colored 'molybdenum blue'** complex. A catalyst is incorporated to ensure complete and rapid color development, and an inhibitor is used to prevent interference from silica. The reagents are provided in the form of two tablets for maximum convenience. The test is simply carried out by adding one of each tablet to a sample of the water.

The intensity of the color produced in the test is proportional to the phosphate concentration, and is measured using a YSI Photometer.

Reagents and Equipment

YSI Phosphate No 1 LR Tablets
YSI Phosphate No 2 LR Tablets
YSI 9300 or 9500 Photometer
Round Test Tubes, 10 ml glass (PT 595)

Test Procedure

- 1 Fill test tube with sample to the 10 ml mark.
- 2 Add one Phosphate No 1 LR tablet, crush and mix to dissolve.
- 3 Add one Phosphate No 2 LR tablet, crush and mix to dissolve.
- 4 Stand for 10 minutes to allow full color development.
- 5 Select Phot 28 on photometer for result as mg/l PO_4 , or Phot 70 for result as mg/l P.
- 6 Take photometer reading in usual manner (see photometer instructions).

Note

Phosphate concentrations can be expressed in a number of different ways. The following factors may be used for the conversion of readings :-

To convert from PO_4 to P_2O_5 - multiply by 0.75

To convert from PO_4 to P - multiply by 0.33

Appendix G

Coliscan MF Instructions

Coliscan[®] MF/Coliscan[®] MF Plus Membrane Filter Kit Instructions

For use with Micrology Laboratories filter apparatus only. Read entire instructions before beginning.

Items needed (minimum):

- | | | | |
|----|---|----|---------------------------|
| 1 | Filter Apparatus (with vacuum device) | 1 | Coliscan MF (Plus) bottle |
| 10 | Membrane Filters | 10 | 50 mm dishes w/ pads |
| 10 | 3 mL Calibrated Droppers (or pipette, any size) | | |

Preparation and setup

1. Thaw the desired number of bottle(s) of Coliscan[®] MF (Plus) by leaving at room temperature overnight. For rapid same-day thawing, stand in warm water until liquid. All unused bottles should be left in freezer. Collect the water to be tested in the appropriate volume and dilution (see table below). It is best to do this within a couple hours prior to filtering or, if this is not possible, water may be stored in refrigerator for no more than 24 hours.

Water amount to be collected

Water Sources	Amount to collect
<u>Environmental:</u>	
River, lake, pond, stream, ditch	1.0 to 5.0 mL added to sterile dilution water (10 to 90 mL)
<u>Drinking water:</u>	
Well, municipal, bottled	100 mL

2. Open a dropper or pipette and sterily add 1.75 to 2 mL Coliscan[®] MF (Plus) to each pad in each dish that is to be used.
3. Filter apparatus setup. The filter apparatus comes in a sterile pack. Open the pack and remove the apparatus. The clear top of the apparatus is the funnel, which is calibrated for 100 and 150 mL samples and is covered with a lid. It fits on the bottom collection container and is sealed with an O-ring. There is a side port with a tip for the attachment of the vacuum syringe. Twist it and it can also be removed. It contains a plug in its tip which can be removed. The contents of the bottom collection container are most easily poured out when the tip is removed. It is easily replaced by twisting back on.
4. To prepare the apparatus for use, remove the funnel and using a clean forceps place a sterile pad on the top grid-work (in the blue circle) of the container.
5. Open a sterile filter envelope and with the clean forceps, carefully remove the membrane filter from the pack. **Be sure to separate the filter from the protective backing and handle the filter carefully so it is not torn or damaged.** Place the filter, grid side up, on top of the sterile pad. Push the funnel down so that it is held and sealed by the O-ring and the filter and pad are held firmly in place. The funnel must be pushed down as far as possible to obtain a good seal.

6. Attach the syringe to the filter apparatus by pushing the end of the hose on to the side port tip of the funnel contained. Be sure that the syringe plunger is not pulled out.

Filtering the water

7. Pour the water sample into the funnel, swirl to mix and create a vacuum by pulling out the plunger of the syringe. The water will be pulled through the filter, depositing any microorganisms present onto the filter surface.
8. When the water sample has been completely passed through the filter, disconnect the syringe, remove the funnel and with the clean forceps remove the filter and place grid side up directly on top of the pad of a dish prepared earlier. Make sure that there are no air spaces (bubbles) between the pad and the membrane filter. Place the lid back on the dish.
9. The filtered water in the collection container should be emptied and the filter apparatus prepared for repeat use. Before the funnel is used again it should be cleaned. This may be done by rinsing with alcohol or radiated for 1 minute with germicidal UV if desired. The absorbent pad can generally be reused as it will only contain filtered water (sterile).

Incubation and interpretation

10. Incubate in an incubator or a warm place. If using an incubator, incubate at 35° for 18- 24 hours. If an incubator is not available, find a place that will be warm for a 24 hour period. **DO NOT** place in direct sunlight or over a direct heat source, radiator, furnace duct etc. You may place them near one of these sources or in a warm spot in the kitchen. Allow 24-48 hours for growth to begin. Once growth begins you can incubate another 24 hours for complete growth to take place.
11. Once the incubation period is complete, a count of the colonies can be done. Count all **blue** colonies as ***E. coli* (fecal coliform)** and all **red colonies** as **general coliforms**. The sum of these two is the **total coliform** population.

Additionally, with Coliscan® MF Plus, verification of *E. coli* is accomplished by shining a long wave (366 nanometer) UV light on the back of the dishes (do this in a dark room). If any of the colonies are *E. coli*, the area around the colonies will fluoresce a bright bluish color. This fluorescence can also be used as proof for the presence of *E. coli* in a sample, thus making the medium an effective P/A test for *E. coli* if quantitative results are not needed.

If you have any questions, call 1.888.327.9435.

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Appendix H

HRSD Custody Form

[illegible]

Appendix I

Illegal Dumping Field Sheet

CITY OF HAMPTON

ILLICIT DISCHARGE FIELD SHEET

☐ Dry Weather Screening

☐ 311 Investigation

☐ Routine Stopping

☐ Other _____

Date: _____ Time: _____

Location: _____

Inspection Team: _____

Last Rain: >72 hrs. <72 hrs. >0.1 in. <0.1 in.

Dry Weather Screening

Structure #: _____ Structure Type: Pipe Outlet Catch Basin Other _____

Dominant Watershed Land Use: Industrial Commercial Residential Mixed Use

Visual Observations: Sediment Buildup Oily Sheen Odor: _____ Color: _____

Flow Observed: Yes No (If Flow is observed, a separate Dry Weather Screening Sheet needs to be filled out)

311 / Routine Investigations

Ticket #: _____

Manager Notified: Yes No

Problem Remediated: Yes No

Literature Given: Yes No

Discharge Type

☐ Oil Spill

☐ Illegal Dumping

☐ Grass Clippings

☐ Pool Water

☐ Car Wash

☐ Other _____

Comments: _____

Lat: _____ Long: _____